

# PATENT ABSTRACTS OF JAPAN

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(54) DEVELOPING METHODDEVELOPING DEVICE AND DISK-LIKE RECORDING MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To form pits of the optimum shape with good accuracy by forming a first exposure part according to recording signals in a resist layerforming a second exposure part according to recording signals in another specified area different from the first areaand stopping development based on the detection results of diffracted light from the second exposure part.

SOLUTION: A resist master glass plate 2 is placed on a turntable 8 and a resist layer 2A is washed with pure water PW from a nozzle 15. A nozzle arm 11 is rotated to stop the nozzle 15 at a specified position on the resist layer 2A. Laser light L1 from a laser light source 16 is made to irradiate a monitoring area. A developer DE is sprayed from the nozzle 15 on the resist layer 2A. When pits or grooves as a latent image becomes to have a desired cross-sectional dimensionthe signal level of signals S1 from a second detector 18 reaches the level of signals S1 which give the level to stop development. At this timean electromagnetic valve 13 is controlled to spray pure water PW through the nozzle 15 instead of the developer DE on the resist layer 2A to stop development.

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CLAIMS

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[Claim(s)]

[Claim 1] By applying a photoresist on the whole surface of a substrate a resist layer is formed and the above-mentioned resist layer rotates a resist master board which it comes to expose based on a record signal and the record signal concerned and a signal that comes to be identical or similar and. The 1st exposure part based on [ supply a developing solution to the above-mentioned resist layer and ] the above-mentioned record signal of the above-mentioned resist layer with the developing solution concerned A developing method detecting light volume of the diffracted light produced by irradiating the 2nd exposure part concerned with a laser beam and stopping development based on the detection result concerned melting the 2nd exposure part based on the above-mentioned record signal and a signal which comes to be identical or similar.

[Claim 2] The developing method according to claim 1 wherein the 2nd exposure part of the above is provided in a predetermined radius position of the above-mentioned resist layer.

[Claim 3] The developing method according to claim 1 exposing the above-mentioned resist layer and becoming so that luminous energy distribution of exposure based on the above-mentioned record signal and a signal which comes to be identical or similar may become uniform [ the 2nd exposure part of the above ].

[Claim 4] The developing method according to claim 1 changing light volume of the above-mentioned diffracted light diffracted by the 2nd exposure part of the above by changing and exposing a rate of PITSUTO of the above-mentioned record signal and a signal which comes to be identical or similar.

[Claim 5] The developing method according to claim 1 making a detection position irradiate with the above-mentioned diffracted light diffracted by the 2nd exposure part of the above by changing and exposing a track pitch of the above-mentioned record signal and a signal which comes to be identical or similar.

[Claim 6] The developing method according to claim 1 making desired pattern shape form in the 1st exposure part of the above by carrying out the specified time lag of the timing which detects light volume of the above-mentioned diffracted light diffracted by the 2nd exposure part of the above.

[Claim 7] A pivot means which a resist layer is formed and the above-mentioned resist layer makes rotate a resist master board which it comes to expose based on a record signal and the record signal concerned and a signal that comes to be identical or similar by applying a photoresist on the whole surface of a substrate A developing solution feeding means

which supplies a developing solution to the above-mentioned resist layer and the 1st exposure part based on the above-mentioned record signal formed in the above-mentioned resist layer using a developing solution supplied from the above-mentioned developing solution feeding means. A developing means which develops the 2nd exposure part based on the above-mentioned record signal and a signal which comes to be identical or similar. A laser light source which irradiates with a laser beam at the 2nd exposure part of the above into development of the above-mentioned resist layer by the above-mentioned developing means. A developer having a light volume detection means to detect light volume of the diffracted light of the above-mentioned laser beam emitted from the 2nd exposure part of the above and stopping development based on a detection result by the above-mentioned light volume detection means.

[Claim 8] The developer according to claim 7 wherein the 2nd exposure part of the above is provided in a predetermined radius position of the above-mentioned resist layer.

[Claim 9] The developer according to claim 7 exposing the above-mentioned resist layer and becoming so that luminous energy distribution of exposure based on the above-mentioned record signal and a signal which comes to be identical or similar may become uniform [ the 2nd exposure part of the above ].

[Claim 10] The developer according to claim 7 changing light volume of the above-mentioned diffracted light diffracted by the 2nd exposure part of the above by changing and exposing a rate of PITSUTO of the above-mentioned record signal and a signal which comes to be identical or similar.

[Claim 11] The developer according to claim 7 making a detection position irradiate with the above-mentioned diffracted light diffracted by the 2nd exposure part of the above by changing and exposing a track pitch of the above-mentioned record signal and a signal which comes to be identical or similar.

[Claim 12] The developer according to claim 7 making desired pattern shape form in the 1st exposure part of the above by carrying out the specified time lag of the timing which detects light volume of the above-mentioned diffracted light diffracted by the 2nd exposure part of the above.

[Claim 13] By applying a photoresist on the whole surface of a substrate a resist layer is formed and the above-mentioned resist layer rotates a resist master board which it comes to expose based on a record signal and the record signal concerned and a signal that comes to be identical or similar and. Supplying a developing solution to the above-mentioned

regist layerand melting the 2nd exposure part based on the 1st exposure part based on the above-mentioned record signal of the above-mentioned regist layerthe above-mentioned record signaland a signal that comes to be identical or similar with the developing solution concerned. A disk shape recording medium which having detected light volume of the diffracted light produced by irradiating the 2nd exposure part concerned with a laser beamand producing based on the detection result concerned as development was stopped.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Table of Contents]This invention is explained in order of the following. the technical field to which an invention belongs -- a Prior art -- the issue which an invention tends to solve -- The means for solving a technical problem -- composition (drawing 1 and drawing 2) of the developer by an embodiment-of-the-invention (1) example (2) Operationand the example besides an effect (3) (drawing 3 - drawing 6) of an example

EFFECT OF THE INVENTION[0002]

[Field of the Invention]This invention is applied to the developing method and developer in a developing processing stage among the making processes of the master optical disk (what is called La Stampa) used as the metallic mold at the time of shaping of the disk shape recording medium which becomes with an optical disc etc.concerning a developing methoda developerand a disk shape recording mediumand is preferred.

[0003]

[Description of the Prior Art]In the manufacturing process of the disk shape recording medium which becomes by optical disca magneto-optical discetc. conventionallyThe process at which the desired uneven patterns (for examplePITSUTO and or groove etc.) according to a record signal produce La Stampa formed in the surfaceIt is divided roughly into a process until it produces the disk base concerned commercially as a disk shape recording medium by transferring the uneven pattern of the request formed in the surface of the La Stampa concerned on a disk base.

[0004]Among thesein the process of producing La Stampaafter washing and drying the whole surface of the glass plate ground first very smoothlya regist layer is formed by applying the photoresist which becomes with photosensitive materials on the whole surface concerned (such a glass

plate is hereafter called a resist master glass plate).

Subsequently after exposing the optical beams (for example laser beam etc.) based on the record signal of the request to this resist layer the uneven pattern according to the signal recorded on the resist layer is formed on the whole surface of a glass plate by developing this.

[0005] In practice such a developing processing stage supplies the developing solution which becomes a resist layer of the resist master glass plate which the exposing treatment process ended for example by alkaline aqueous solution such as metasilicic acid sodium and is performed by dissolving the portion by which the resist layer concerned was exposed with the developing solution concerned.

[0006] Then the electric conduction-ized membrane layer which becomes with silver or nickel with technique such as sputtering vacuum evaporation or unelectrolyzed METSUKI is formed on the surface of the uneven pattern concerned. Then the metal skin which becomes with the nickel etc. which have predetermined thickness on this electric conduction-ized membrane layer by electrocasting is formed. After tearing off an electric conduction-ized membrane layer and a metal skin from a glass plate to one after this furthermore this is pierced to specified shape. Thereby the uneven pattern according to a record signal can obtain La Stampa which it comes to form in the whole surface.

[0007]

[Problem(s) to be Solved by the Invention] By the way after carrying out exposure recording of the record signal to the resist layer of a resist master glass plate using an optical beam in this way according to the method of forming the uneven pattern according to the record signal concerned by developing this. PITSUTO which becomes with this uneven pattern -- and -- or it is necessary to require the exposure precision in an about 1-micron unit and for the portion (the following and this portion -- PITSUTO -- and -- or it is called a groove equivalent part) equivalent to a groove to be faithfully developed by the resist layer according to the demand concerned.

[0008] namely PITSUTO formed in a resist layer of a developing processing stage -- and -- or since the depth and width of a groove equivalent part are expressed as a size of a section vertical to the track direction of the optical beam irradiated they relate to the accuracy of the information detection by the laser beam in an optical disk system closely. therefore a developing processing stage -- this PITSUTO -- and -- or it is necessary to be managed so that the depth and width (this depth and width are hereafter called the cross section size) of a groove equivalent part may serve as a value in a prescribed range.

[0009]for this reason -- while irradiating with the laser beam for a monitor into development at the resist layer of a glass plate using the diffraction development of the light by the unevenness on a flat face -- PITSUTO -- and -- or the laser beam ingredient diffracted by the groove equivalent part [ detect and ] stopping a development when the intensity of the diffracted light reaches a predetermined value -- PITSUTO -- and -- or the method of controlling the cross section size of a groove equivalent part is proposed.

[0010]The developer used when producing La Stampa of the disk shape recording medium which is embodying this method by \*\*\*\* intermediary for example an optical disc or an optical magnetism (MO: Magnet Optical) disk is explained.

[0011]PITSUTO [ cutter / master code ] corresponding [ on this developer and ] to the record signal of the request to a resist layer beforehand first -- and -- or while a groove equivalent part rotates the resist master glass plate which it comes to form as a latent image a developing solution is sprinkled on the resist layer of the resist master glass plate concerned.

[0012]PITSUTO formed in the resist layer of a resist master glass plate in this state -- and -- or it dissolving gradually and the latent image of a groove equivalent part with a developing solution The laser beam for a monitor is irradiated by the latent image formed in the resist layer concerned from the laser light source which it comes to arrange above a resist master glass plate simultaneously with this.

[0013]The detector is provided in the prescribed position besides the optical path of the laser beam discharged here from the laser light source concerned in the opposite hand of the laser light source to a resist master glass plate. in this case PITSUTO by which a part of laser beam discharged from the laser light source is formed in a resist layer -- and -- or from a determined direction diffracting in a groove equivalent part. After the primary diffracted light of this diffracted laser beam penetrates a resist master glass plate it is made as [ enter / into the detector concerned ].

[0014]PITSUTO formed in the resist layer of a resist master glass plate in practice -- and -- or when it irradiates with a laser beam developing negatives to the latent image of a groove equivalent part the percentage of completion of development -- \*\*\*\*\* PITSUTO -- and -- or -- the depth of a groove equivalent part responds to increase and this -- the PITSUTO concerned -- and -- or the light volume of the primary diffracted light diffracted in the groove equivalent part changes.

[0015]Therefore in this developer development is stopped based on the

comparison result concerned by measuring the light volume of the primary diffracted light detected by the detector with the predetermined light volume set up beforehand. PITSUTO which becomes in the desired depth by this -- and -- or a groove equivalent part can be obtained.

[0016]By the way as a disk shape recording medium in recent years the optical disc only for playback (CD) and the discrete information pattern as a preformat -- and -- or the optical disc (MD) in which the guide rail for tracking (groove) was formed beforehand and which can be written in. Or various things such as a magneto-optical disc (MO) written in by 1 time twice four double densities etc. and also a digital video disc (DVD) are used.

[0017]However when manufacturing using the developer which mentioned above La Stampa used as a metallic mold of such various disk shape recording media respectively The problem which becomes difficult [ it / to set all the irradiation positions of the laser beam to each resist master glass plate as a preprocessing stage of La Stampa of these versatility as the same radius position in a developing processing stage ] since a record section changes with kinds of disk shape recording media respectively is \*\*\*\*\*. It is dramatically difficult to give compatibility for the installed position of a laser light source and a detector by LD and MD since the record section has estranged extremely especially by LD and MD respectively and it is \*\*\*\*\*.

[0018]Disk shape recording media by which high density recording was carried out such as MO recorded by double density or four double densities and DVD Since a track pitch differs from CD which becomes with the usual storage density when the developer mentioned above is used PITSUTO of a resist master glass plate -- and -- or the problem of the degree of angle of diffraction of the primary diffracted light diffracted in the groove equivalent part changing and the primary diffracted light concerned stopping entering into a detector as a result -- \*\*\*\*\*.

[0019]every disk shape recording medium -- the optimal PITSUTO -- and -- or the optimal PITSUTO corresponding to each since the cross section sizes of a groove differ respectively -- and -- or in order to form a groove using the developer mentioned above -- PITSUTO on each resist master glass plate -- and -- or the necessity of enlarging the dynamic range of a detector so that it can respond to change of the light volume of the primary diffracted light diffracted in the groove equivalent part -- \*\*\*\*\*.

[0020]The latent image of the wide groove is carried out on the resist master glass plate as a preprocessing stage of La Stampa used as a

metallic mold of the disk shape recording medium which becomes by magneto-optical disc such as MD. In forming the wide groove concerned using the developer mentioned above, the light volume of the primary diffracted light diffracted by the wide groove concerned has the feature which decreases gradually after the rate of increase becomes low and passes through the maximal value gradually although it increases to a detector immediately after an incidence start. For this reason, the problem which becomes very difficult [ it / to develop negatives in the developing method using the developer which stops development when the light volume of the primary diffracted light is more than the predetermined light volume set up beforehand and which was mentioned above ] is \*\*\*\*\*.

[0021] PITSUTO which this invention was made in consideration of the above point and becomes in the shape optimal irrespective of the kind of disk shape recording medium -- and -- or it is going to propose the developing method, developer and disk shape recording medium which can form a groove with sufficient accuracy.

[0022]

[Means for Solving the Problem] In [ in order to solve this technical problem ] this invention By applying a photoresist on the whole surface of a substrate, a resist layer is formed and a resist layer rotates a resist master board which it comes to expose based on a record signal and the record signal concerned and a signal that comes to be identical or similar and. The 1st exposure part based on [ supply a developing solution to a resist layer and ] a record signal of a resist layer with the developing solution concerned. Melting the 2nd exposure part based on a record signal and a signal which comes to be identical or similar light volume of the diffracted light produced by irradiating the 2nd exposure part concerned with a laser beam is detected and it is made to stop development based on the detection result concerned.

[0023] Thus, to a resist layer of a resist master board, not only in the 1st exposure part according to a desired record signal, the 2nd exposure part according to the record signal concerned and a signal which comes to be identical or similar is also formed in a predetermined region different from the 1st exposure part concerned. PITSUTO which becomes in shape optimal irrespective of a kind of disk shape recording medium by having made it stop development based on a detection result of light volume of the diffracted light diffracted by the 2nd exposure part concerned -- and -- or a groove can be formed with sufficient accuracy.

[0024]

[Embodiment of the Invention] About a drawing, one example of this



invention is explained in full detail below.

[0025](1) The rotation part 3 which 1 shows a developer as a whole and holds the resist master glass plate 2 in the lineblock diagram 1 of the developer by an example enabling free rotation. It has the spindle 5 fixed to the base plate 4 and the end axis 5A of this spindle 5 is engaging with the output shaft 7A of the servo motor 7 via the belt 6 in the base-plate 4 bottom.

[0026]The turntable 8 is attached to the end axis 5B of the spindle 5 in the base-plate 4 upper part and it is made as [ carry out / adsorption maintenance of the resist master glass plate 2 laid on this turntable 8 ]. When the belt 6, the spindle 5 and the turntable 8 interlock according to rotation of the servo motor 7 in this way, the resist master glass plate 2 may rotate to an opposite direction with the direction of this which shows by the arrow a.

[0027]the chamber 9 which becomes the circumference of the spindle 5 with specified shape is formed in the upper surface of the base plate 4 -- the arm buck 10 is both being stood erect and fixed to the adjoining position of the chamber 9 concerned. The arm supporting part 10A is supported by the upper bed part of this arm buck 10 free [ the direction of this which shows by the arrow b ] for rotation to an opposite direction and it is attached to the arm supporting part 10A concerned so that the end of the nozzle arm 11 and the end of the pipe 12 may be mutually open for free passage.

[0028]The output of the electromagnetic valve (three way valve) 13 is connected with the other end of this pipe 12 and external connection of developing solution DE and the pure water PW is carried out to two input control ports of the electromagnetic valve 13 concerned.

Furthermore based on control of the control section 14, the switching action of the output is carried out and this electromagnetic valve 13 is made as [ carry out / selectively / the switching action of the two input control ports ]. Thereby either one of developing solution DE or the pure water PW is selectively supplied in the pipe 12 via an output.

[0029]On the other hand, the nozzle 15 is attached to the other end of the nozzle arm 11 and it is made from the tip of this nozzle 15 as [ sprinkle / developing solution DE or the pure water PW supplied via the pipe 12 and the nozzle arm 11 ].

[0030]After the nozzle 15 has been arranged by rotation of the arm supporting part 10A above the resist master glass plate 2 in this way, developing solution DE or the pure water PW is sprinkled on the resist layer 2A of the resist master glass plate 2 via the pipe 12, the nozzle arm 11 and the nozzle 15. Then after sprinkled developing solution

DE or the pure water PW flows down on the resist master glass plate 2 it is collected within the chamber 9.

[0031] by the way PITSUTO by which exposing treatment was beforehand carried out to the resist layer 2A of the resist master glass plate 2 by the master code cutter etc. according to the desired record signal -- and -- or the field (this is hereafter called a record signal area) corresponding to the latent image of a groove equivalent part is formed. PITSUTO by which became in the predetermined region other than the record signal area concerned and exposing treatment was carried out according to the record signal concerned and the signal which comes to be identical or similar -- and -- or the field (this is hereafter called a development monitor range) corresponding to the latent image of a groove equivalent part is formed.

[0032] In the upper prescribed position of the resist master glass plate 2. The laser light source 16 which becomes with the short semiconductor laser of coherent length is formed and it is made as [ glare / the development monitor range where the laser beam L1 was formed in the resist layer 2A of the resist master glass plate 2 from the laser light source 16 concerned ].

[0033] Incidentally irrespective of the size of the surface of a resist master glass plate and the kind of disk shape recording medium which fabricates La Stampa obtained from a \*\*\*\*\* resist master glass plate as a metallic mold the laser light source 16 is fixed so that a development monitor range may always serve as a fixed radius position.

[0034] On the other hand the 1st and 2nd detectors 17 and 18 are formed in the prescribed position on the optical path of the laser beam L1 discharged from the laser light source 16 concerned in the opposite hand of the laser light source 16 to the resist master glass plate 2 and besides the optical path concerned respectively.

[0035] namely a development monitor range -- yet -- PITSUTO -- and -- or when the groove equivalent part is not formed It enters into the 1st detector 17 after penetrating the resist master glass plate 2 as the zero-order diffracted light L1A as it is without diffracting a part of laser beam L1 discharged from the laser light source 16 in a development monitor range.

[0036] on the other hand -- a development monitor range -- PITSUTO -- and -- or when a groove equivalent part is formed Since a part of laser beam L1 discharged from the laser light source 16 is diffracted by the determined direction in a development monitor range the primary diffracted light L1B of this diffracted laser beam L1 enters into the 2nd detector 18 after penetrating the resist master glass plate 2.

[0037]In this casefirstthe 2nd detector 18 sends out the electrical signal S1 which comes to be the detection result concerned to the comparing element 19after detecting the light volume of the primary diffracted light L1B which entered. The development stop level signal S2 which consists of the electrical signal S1 and the exterior with a predetermined signal level is inputted into this comparing element 19and the comparison signal S3 which becomes by the comparison result concerned is sent out to the control section 14 by comparing the signal level of the electrical signal S1 concerned with the signal level of the development stop level signal S2.

[0038]Based on the comparison signal S3the control section 14 sends out development stop signal S4 to the electromagnetic valve 13when the signal level of the electrical signal S1 reaches the signal level of the development stop level signal S2. Since developing solution DE is sprinkled on the resist layer 2A of the resist master glass plate 2 at this timeopen operation of the input control port of developing solution DE is carried outand the electromagnetic valve 13 has an input control port of the pure water PW in the state where it closed-operated.

[0039]In this stateif development stop signal S4 is inputted into the electromagnetic valve 13the input control port of developing solution DE will be made closed operationand the electromagnetic valve 13 concerned will be changed to the state where open operation of the input control port of the pure water PW was carried out. As a resultby sprinkling the pure water PW on the resist layer 2A of the resist master glass plate 2developing solution DE sprinkled on the resist layer 2A concerned will be flushed with the pure water PWand advance of development will be stopped in this way.

[0040]On the other handthe 1st detector 17 sends out the electrical signal S5 which comes to be the detection result concerned to the comparing element 21 in the quantity of light control part 20after detecting the light volume of the zero-order diffracted light L1A which entered. In this quantity of light control part 20the reference signal S6 which consists of the electrical signal S5 and the exterior with a predetermined signal level is inputted into the comparing element 19and the comparison signal S7 which becomes by the comparison result concerned is sent out to the control section 22 by comparing the signal level of the electrical signal S5 concerned with the signal level of the reference signal S6.

[0041]The control section 14 sends out the control signal S8 to the laser driver 23 so that the difference of the signal level of the electrical signal S5 and the signal level of the reference signal S6 may

be canceled and it may be set to the same signal level based on the comparison signal S7.

[0042]By carrying out drive controlling of the laser light source 16 based on the control signal S8the laser driver 23 is made as [ maintain / at the state where it was always stabilized / the light volume of the laser beam L1 discharged from the laser light source 16 concerned ]. As a resulton the optical path of the laser beam L1 until it reaches the development monitor range formed in the resist layer 2A of the resist master glass plate 2 from the laser light source 16Even when floating disturbance elementssuch as dust and fluctuation of a misty state developing solutionexistthe light volume of the primary diffracted light L1B can be maintained at the state without disorder where it was stabilizedand the detecting accuracy of the light volume of the primary diffracted light L1B can be prevented from deteriorating in the 2nd detector 18 in this way.

[0043]PITSUTO which did in this way and was formed in the resist layer 2A -- and -- or after forming the electric conduction-sized membrane layer which becomes with nickel etc. about the duplicate of the resist master glass plate 2 which has a groove equivalent partLa Stampa is produced by METSUKI [ with electrocasting ]. fabricating to the transparent resin which becomes with PMMA (polymethylmethacrylate) or PC (polycarbonate)using this La Stampa as a metallic mold -- PITSUTO -- and -- or the transparent base by which the groove was transferred is formed. these PITSUTO -- and -- or a metal membrane or a magneto optical film etc. which reflects light is provided in the surface containing a groovein order that a protective film may protect signal PITSUTO and a reflection film furtherit is providedand disk shape recording mediasuch as CDLDor MOare manufactured in this way.

[0044]Incidentallyas shown in drawing 2record signal area  $A_1$  and development monitor range  $A_2$  are formed in the resist layer 2A of the resist master glass plate 2. As a resultPITSUTO of record signal area  $A_1$  becomes a predetermined cross section sizePITSUTO of development monitor range  $A_2$  also becomes a predetermined cross section sizeand the pattern of interference as shown in drawing 2 appears in the resist layer 2A of the resist master glass plate 2.

[0045](2) In operation of an exampleand the composition beyond an effect to the resist layer 2A of the resist master glass plate 2. PITSUTO by which exposing treatment was carried out according to the desired record signal -- and -- or the latent image of a groove equivalent part being beforehand formed as a record signal areaand. PITSUTO by which exposing treatment was carried out to the predetermined region other than the

record signal area concerned according to the record signal concerned and the signal which comes to be identical or similar -- and -- or the latent image of the groove equivalent part is beforehand formed as a development monitor range.

[0046]In this case the laser beam L1 for a monitor discharged from the laser light source 16 is irradiated by the development monitor range formed in the resist layer 2A of the resist master glass plate 2 and. So that the primary diffracted light L1B diffracted by the determined direction in the zero-order diffracted light L1A penetrated without diffracting in the development monitor range concerned and the development monitor range concerned can receive light by the 1st and 2nd detectors 17 and 18 respectively. The laser light source 16 and the 1st and 2nd detectors 17 and 18 are fixed to the prescribed position respectively.

[0047]In the developer 11 laying this resist master glass plate 2 in the turntable 8 first and making it rotate the pure water PW is sprinkled from the nozzle 15 and the resist layer 2A is rinsed here. Then rotate the nozzle arm 11 and the prescribed position on the resist layer 2A is made to stop the nozzle 15 and the development monitor range formed in the resist layer 2A is irradiated with the laser beam L1 from the laser light source 16.

[0048]Then developing solution DE is sprinkled on the resist layer 2A from the nozzle 15 rotating the resist master glass plate 2 according to rotation of the turntable 8. PITSUTO which becomes by the latent image formed in the development monitor range in this state -- and -- or when a groove equivalent part serves as a desired cross section size the signal level of the electrical signal S1 outputted from this simultaneously the 2nd detector 18 will reach the signal level of the development stop level signal S2. At this time switching control of the electromagnetic valve 13 is carried out by the control section 13 developing solution DE is flushed to developing solution DE and it is made to stop development by sprinkling the pure water PW on the resist layer 2A from the \*\*\*\* intermediary nozzle 15.

[0049]thus PITSUTO -- and -- or by carrying out by detecting the light volume of the primary diffracted light L1B diffracted not in a record signal area but in the development monitor range in the operation which stops development when a groove equivalent part serves as a desired cross section size. Operation which always stops development can be performed irrespective of the size of the surface of a resist master glass plate. As a result the complicatedness to which arrangement of the laser light source 16 and the 1st and 2nd detectors 17 and 18 is moved according to the size of the surface of a resist master glass plate is

avoidable.

[0050] According to the above composition to the resist layer 2A of the resist master glass plate 2, PITSUTO according to a desired record signal -- and -- or only not only in the record signal area which becomes by the latent image of a groove equivalent part PITSUTO according to the signal which comes to be identical or similar to a predetermined region other than the record signal area concerned as the record signal concerned -- and -- or the development monitor range which becomes by the latent image of a groove equivalent part also being formed and PITSUTO which becomes in the shape optimal irrespective of the kind of disk shape recording medium by having made it stop development based on the detection result of the light volume of the primary diffracted light L1B diffracted in the development monitor range concerned -- and -- or a groove can be formed with sufficient accuracy.

[0051] (3) In other examples in addition above-mentioned examples PITSUTO by which exposing treatment was beforehand carried out to the resist layer according to the desired record signal and the signal which comes to be identical or similar by the master code cutter etc. -- and -- or although the case where the latent image of a groove equivalent part was formed as a development monitor range was described It may be made for this invention to change the light volume (this is hereafter called record light volume) of the exposure based on a desired record signal and the signal which comes to be identical or similar in the exposing treatment process for forming not only this but a development monitor range.

[0052] That is as shown in drawing 3 in an exposing treatment process it is the record light volume of a development monitor range respectively 1.0 [mJ/m] 1.2 [mJ/m] 1.5 [mJ/m] And 1.8 [mJ/m] When it set up and exposes in a developing processing stage the signal level of the development stop level signal S2 accompanying progress of each developing time is in the tendency which increases in proportion to the size of each record light volume.

[0053] When developing time is made into 30 seconds according to this graph the record light volume of a development monitor range is 1.0. [mJ/m] 1.2 [mJ/m] 1.5 [mJ/m] And 1.8 Signal level  $V_{b1}$   $V_{b2}$   $V_{b3}$  and  $V_{b4}$  of the development stop level signal S2 corresponding to [ time of [mJ/m] ] these are 2.4 respectively. [V] 4.2 [V] 6.2 [V] And 6.8 [V] It can read becoming. It turns out that the signal level of the development stop level signal S2 in each record light volume of a development monitor range is dependent on developing time by this.

[0054] By changing the record light volume of a development monitor range

in this way the signal level of the development stop signal S2 can be changed according to change of the record light volume concerned. By the way it is common that thickness differs according to the kind of disk shape recording medium respectively in practice and there is the feature with which the light volume of the primary diffracted light L1B diffracted in proportion to the thickness of the resist layer 2A in the developing processing stage in the development monitor range of the resist layer 2A concerned increases.

[0055] for this reason PITSUTO which becomes in the optimal shape -- and -- or by changing the record light volume of a \*\*\*\* intermediary and a development monitor range to forming a groove equivalent part and changing the signal level of the \*\*\*\*\* development stop signal S2 to change Change of the light volume of the primary diffracted light L1B can be suppressed to some extent and as a result it is not necessary to enlarge the dynamic range of the 2nd detector 18 and ends.

[0056] Also when PITSUTO it not only changes the record light volume of a development monitor range but formed in the development monitor range in the exposing treatment process makes it change comparatively (for example duty ratio etc.) Change of the light volume of the primary diffracted light L1B can be suppressed to some extent and the same effect as the case where it is \*\*\*\* can be acquired.

[0057] Although the case where the developer 1 was applied to the resist master glass plate corresponding to disk shape recording media such as CD which becomes with the usual storage density was described in the further above-mentioned example without limiting especially the target disk shape recording medium It may be made for this invention to apply the developer 1 to the resist master glass plate corresponding to disk shape recording media by which high density recording was carried out such as not only this but MO recorded for example by double density or four double densities and DVD.

[0058] In this case generally at the usual storage density a track pitch is 1.6. [μm] Although it becomes PITSUTO [ in / with the resist master glass plate corresponding to the disk shape recording medium by which high density recording was carried out / a development monitor range ] -- and -- since [ or ] the track pitches of a groove equivalent part differ -- the PITSUTO concerned -- and -- or the degree of angle of diffraction of the primary diffracted light L1B diffracted in the groove equivalent part will change. For this reason there is a possibility that light may no longer be received by the 2nd detector 18 depending on the degree of change of the degree of angle of diffraction of the primary diffracted light L1B.

[0059]PITSUTO [ in / on an exposing treatment process since a development monitor range becomes in a field other than a record signal area that this problem should be solvedand / the development monitor range concerned ] -- and -- or the track pitch of a groove equivalent part -- about 1.5-1.7 By setting up and carrying out exposing treatment to [mum]the primary diffracted light L1B can be received by the 2nd detector 18. The complicatedness which moves arrangement of the 2nd detector 18 and the laser light source 16 by this can be avoidedand flexibility can be increased to various kinds of optical disc formats of a different track pitch in this way.

[0060]In the further above-mentioned examplewith the developer 1when the light volume of the primary diffracted light L1B reached the predetermined light volume corresponding to the signal level of the development stop level signal S2 set up beforehanddescribed the case where it was made to stop developmentbut. It may be made for this invention to detect the light volume of the primary diffracted light L1B concerned after specified time elapse about that in which the light volume of not only this but the primary diffracted light L1B does not carry out the increase in \*\*\*\*\* at the passage of time.

[0061]In the disk shape recording medium which becomes by magneto-optical discsuch as MDconcretelythe latent image of the wide groove is carried out to the development monitor range of the resist layer 2A of the resist master glass plate 2 in an exposing treatment process. this -- wide -- a groove -- diffracting -- having had -- one -- order -- the diffracted light -- L -- one -- B -- light volume -- for example -- drawing 4 -- being shown -- as -- the -- two -- a detector -- 18 -- incidence -- a start -- a time --  $t_0$  -- from -- increasing -- gradually -- the rate of increase -- low -- becoming -- the maximal value -- having passed -- after -- gradually -- decreasing -- a time --  $t_3$  -- beforehand -- setting up -- having had -- predetermined -- light volume -- reaching .

[0062]In this caseit is set to the same signal level Vb as time  $t_3$  also in time  $t_1$ and there is a possibility of stopping development by time  $t_1$ in the developing method using the developer 1. By setting up beforehand in the comparing element 19 by making time from  $t_0$  to time  $t_2$  into mask time at the time for this reasonthe light volume of the primary diffracted light L1B is detected after the mask time progress concerned.

[0063]In a further above-mentioned examplealthough the case where it was made to become with the composition that the quantity of light control part 20 is shown in drawing 1 was describedthis invention may use the



quantity of light control part 31 like drawing 5 which attached and showed identical codes to the corresponding point not only with this but drawing 1.

[0064] In this case the developer 30 in drawing 5 consists of the almost same composition as the developer 1 mostly shown in drawing 1 except quantity of light control part 31. That is the electrical signal S5 which comes to be a detection result of the light volume of the zero-order diffracted light L1A is inputted from the 1st detector and the reference signal S11 which consists of the exteriors with a predetermined signal level is inputted into the comparing element 32 of the quantity of light control part 31. Thereby the comparing element 32 sends out the comparison signal S10 which becomes by the comparison result concerned to the control section 33 by comparing the signal level of the electrical signal S5 with the signal level of the reference signal S11.

[0065] The control section 33 sends out the control signal S12 to the modulator driver 34 so that the difference of the signal level of the electrical signal S5 and the signal level of the reference signal S11 may be canceled and it may be set to the same signal level based on the comparison signal S10. Here the modulator 35 which becomes for example by EO (electrooptics element) a liquid crystal AOM (acoustooptic deflector) etc. is attached on the optical path of the laser beam L1 until it reaches the development monitor range formed in the resist layer 2A of the resist master glass plate 2 from the laser light source 16.

[0066] By this the modulator driver 34 by carrying out drive controlling of the laser light source 16 and the modulator 35 based on the control signal S12 on the optical path of the laser beam L1 until it reaches the development monitor range formed in the resist layer 2A of the resist master glass plate 2 from the laser light source 16. Even when floating disturbance elements such as dust and fluctuation of a misty state developing solution exist, the light volume of the primary diffracted light L1B can be maintained at the state without disorder where it was stabilized and the detecting accuracy of the light volume of the primary diffracted light L1B can be prevented from deteriorating in the 2nd detector 18 in this way.

[0067] Furthermore gas lasers such as not only a semiconductor laser but helium neon (helium-Ne) laser, helium cadmium (helium-Cd) laser, argon (Ar) laser, krypton laser ( $Kr^+$ ) laser etc. may be used like an example in this case. In this case a gas laser can be applied in the developer 30 by having used the modulator 35 although it becomes by the bad laser light source of control response nature compared with a semiconductor laser.

[0068]

[Effect of the Invention]According to this inventionto the regist layer of a resist master board as mentioned above only not only in the 1st exposure part according to a desired record signalThe 2nd exposure part according to the record signal concerned and the signal which comes to be identical or similar is also formed in the predetermined region different from the 1st exposure part concernedBy having made it stop development based on the detection result of the light volume of the diffracted light diffracted by the 2nd exposure part concernedPITSUTO which becomes in the shape optimal irrespective of the kind of disk shape recording medium -- and -- or the developing methoddeveloperand disk shape recording medium which can form a groove with sufficient accuracy are realizable.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a partial approximate line figure showing the entire configuration of the developer by an example.

[Drawing 2]It is an approximate line figure showing the formed state of the development monitor range by an example.

[Drawing 3]It is a graph showing the characteristic of the record light volume of the development monitor range by other examples.

[Drawing 4]It is a graph with which explanation of the mask time in other examples is presented.

[Drawing 5]It is a partial approximate line figure showing the entire configuration of the developer by other examples.

[Description of Notations]

130 .... A developer2 .... A resist master glass plate2A .... Regist layer3 [ .... A nozzle16 / .... A laser light source17 / .... The 1st detector18 / .... The 2nd detector19 / .... A comparing element20 31 / .... A quantity of light control partDE / .... A developing solutionPW / .... Pure water. ] .... A rotation part13 .... An electromagnetic valve14 .... A control section15

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